least pain to the patient, or without reopening the wound. Another mode of obliterating the carotid, as well as other arteries, in a gradual manner, may be effected, by transfixing the vessel with delicate pins or needles, so as to destroy the arterial tissue of the part, and cause its gradual contraction and final obliteration. This expedient I have employed, but not with the larger order of arteries, and think well of it. If the transfixing is effectually done, entirely around the artery, for eight or ten lines in extent, it will seldom fail to cause the obliteration of arteries of moderate calibre; and the larger order I should suppose would be equally liable also to its obliterating effects, if the agency is effectually used.

In conclusion, I will merely state that an error has crept into the closing paragraph of the Report of the Committee on Surgery, touching the autopsy of my cases as respects the softening of the brain. The softening was on the side of the operation, and not, as stated in the report, on the opposite side. It is probable that I committed the mistake myself, in the hasty preparation of the paper transmitted to Dr. Norris, as I have found it difficult to avoid a like one in drawing up this.

PRINCE EDWARD COURT HOUSE, VA., *March 2d*, 1849.

ART. IV.—*Case of Lead Poisoning, with Recovery.* By JNO. C. DALTON, Jr., M. D. Read before the Boston Society for Medical Observation, June 5, 1848.

ELIZA T., a healthy looking child, four years of age, with light hair, brown eyes, and a delicate skin, entered the Massachusetts General Hospital, April 8, 1848, with partial paralysis of the upper and lower extremities. The friends reported that she, as well the other members of her family, was generally healthy; that three months before entrance she was first noticed to be weak in her feet and legs—more so on some days—less so on others; that this weakness gradually increased, with short intervals of temporary improvement, until she entirely lost the use of her lower extremities; so that for the six weeks preceding her entrance she had not been able to stand. Her hands had also become affected in a similar manner, the paralysis having been noticed in them about a month after it was first observed in the feet. She had had blisters and leeches to the spine, but no other treatment. For the last two weeks she had been rather improving, but was still nearly helpless.

At the time of her entrance, she presented the following appearances: Her countenance was fair, slightly pallid, in good flesh, and without decided morbid expression. She had, however, a certain air of flaccidity, or softness of tissue, which we often see in children not absolutely invalids, but which still seems not quite compatible with robust health. Her manner was depressed, timid, silent. She passed most of her time sitting upon the bed, and while in this position her feet dropped over, and inclined inward, so as nearly to rest on their inner border, apparently from paralysis of the extensors which should have supported them in an upright position. The toes also remained moderately flexed, and she could not extend them. There was much apparent laxity of the ankle joint, and the patient was incapable of moving the feet, or of supporting the weight of her body upon them. When she was lifted up in the arms of an assistant, she cried out, and drew up her feet under her body, for fear she should be made to attempt standing on them. The feet also appeared to be tender, as she cried whenever they were freely handled.

The hands were paralyzed to about the same extent as the feet. They hung down at right angles from the forearms, and could not be raised at the will of the patient. The wrist-joints looked flaccid and powerless, like the ankles. When the forearms were placed in the supine position, and then pronated, the hands dropped suddenly down into their hanging position, as if they had been attached to the forearms by hinges. The flexors seemed also to be somewhat paralyzed, but not nearly so much as the extensors, since she could take hold of a stick and pull upon it with considerable force. There was no well-marked emaciation, except of the bundle of muscles composing the ball of the thumb. These were wasted almost entirely away, so that the shape of the metacarpal bone of the thumb could be distinctly traced through the integuments.

There was no tenderness, curvature, or other morbid appearance about the spine. The skin was of natural temperature, a little dry. Pulse 140, rather feeble. Respiration quiet; appetite reported good; tongue of natural colour, clean and moist. There was a distinct dark blue line on the edges of the gums about the upper incisor teeth;—none elsewhere. The gums were otherwise quite natural. The patient complained of no pain, except when an attempt was made to move her hands or feet; she would then cry out, apparently as much from fear as from actual suffering.

On further inquiry, it appeared that, for nearly a year past, the patient had been subject to constipation and to occasional attacks of nausea and vomiting. These attacks were never very severe, and lasted usually about two days. With these exceptions her health had been good. She had never had colic at any time. Three months ago she had one of her attacks of nausea, and about the same time went to live at Charlestown, where she resided for a fortnight. She had nausea occasionally during the time, and when she returned to the city her friends first observed the weakness in her legs and feet. Since then she had often been irritable, and cried as if in pain, but had never referred her distress to any particular part of her body or limbs. Her intelligence had never been affected.

While in Charlestown, she lived at a house where the family use, for drink, "hard water" from a pump. For three weeks previously, she had lived at the "Hanover House," Hanover St., where they use spring water. For two months previous to this, she had lived at No. 21 Porter St. The only water used here is "aqueduct water," from Jamaica Pond, which is brought to the middle of the street in wooden tunnels, and thence distributed over the house through leaden pipes. While here, she was reported to have been much neglected by her parents, and often exposed to cold and wet. The family living at this house had all been well during the past year.

For six weeks previously, the patient had lived at No. 5 Medford Court, which is supplied with aqueduct water, also brought to the middle of the street in wooden tunnels, and distributed over the house through leaden pipes. Several members of this family had been repeatedly troubled, during the past year, with pain in the abdomen, sometimes accompanied with diarrhœa, sometimes not. The mother of the patient had lived with her at the above-mentioned places, and reported herself to have been quite well during that time. Since the commencement of her illness, the patient had lived at a house in Dover St., where aqueduct water is used through leaden pipes, as in Porter St., and Medford Place.

She had had no medicine during the past year, except castor oil and senna, occasionally administered by her mother.

The history and symptoms of the case were considered as indicating, in a very satisfactory manner, the poisonous influence of lead. The patient was immediately put upon house diet, and the use of the following: ℞. Acid. sulph. aromat., ʒi; sulphur. sublimat., ʒi; sirup. limonis, ℥i; mucil. gum. acac., ℥vi; M. Sumend. ʒii, ter in die. Two days afterwards she had some looseness of the bowels, with pain, and the dose was restricted to twice a-day; after which her bowels continued regular.

On the 15th, two caustic issues, each one inch long by half an inch wide, were made, one on each side of the upper cervical vertebræ. After the separation of the sloughs, the issues were kept open by dressing with ung. inf. cantharid.

Under this treatment, she soon began to improve. On the 20th of April, not quite two weeks after her entrance, the record was as follows: "Some improvement, apparently, in hands; can extend fingers, especially those of left hand, somewhat; wrist-joints, also, seem not quite so flaccid. Ankles still perfectly loose and powerless. Otherwise same. Pulse 140. Tongue and skin natural. Appetite good. Bowels regular. Blue line remains round upper front gums."

On the 27th, one week later, it had become certain that she was regaining her muscular power. The record of that date says: "Undoubted improvement in hands, and also in feet. Can extend fingers more than at last date, though this movement is still very imperfect. Wrists continue 'dropped.' Feet and ankles remain same in appearance, but patient can bear a little weight on them without complaining. A little pain in bowels once since 14th inst.; none else. No more vomiting. Always takes food with relish. Bowels open once, sometimes twice a-day. Discharges quite natural in appearance and consistency."

From that time, her improvement was constant and uniform; without any sudden alteration, or the development of any new symptom. On the 11th of May, one month after her entrance, she walked into the next ward, with only a very little assistance from the nurse; and about this time she began to be carried out into the open air whenever the weather was sufficiently mild. On the 25th of May, six weeks after her entrance, the record was as follows:—

"Is no longer confined to bed, but walks about ward most of time. Usually supports herself by placing hands against sides of room, but can walk a short distance without any support. Has improved in flesh and aspect. Manner less timid than on entrance. Pulse 108. Blue line almost gone."

During the first three weeks after her entrance she had frequent and scanty micturition; so that the nurse, as she reported, was obliged to attend to her almost every time she came into the ward. The passage of urine, however, did not at any time appear to be accompanied by pain. No systematic analysis of the secretion was resorted to, and no test was applied for lead, except the addition, on several occasions, of hydrosulphate of ammonia to the unconcentrated urine. This never produced any discoloration.

The blue line faded from the patient's gums in about the same proportion as the strength returned in her feet and hands; and her manner, which was at first depressed and timid, became gradually more confident and cheerful.

She has now so far recovered, that she walks about without assistance, quite as much as children of her age usually do; and the only remaining vestige of her paralysis, is a certain awkwardness in the movements of her feet, which, however, constantly diminishes. The tenderness of her lower extremities has nearly, though not quite, gone; and there is no trace of the blue line to be detected on her gums. The hands are still slightly emaciated.

She has continued, without alteration, the medicine which was prescribed at first; and the issues which were made soon after her entrance are still open.

The rapidity of her pulse, which was a well-marked symptom, continued for a long time.

On the 10th of April, it was 140.
" " 13th " " 140.
" " 14th " " 144.
" " 20th " " 140.
" " 27th " " 148.
" " 3d of May " 136.
" " 19th " " 120.

It is now pretty regular at 108, which, I suppose, is not a great deal too rapid for a female child, four years of age. Sometimes, however, it gets up to 120 towards night.

There are several points in the above case, which deserve particular attention. And, first, with regard to the palsy :—

1. This is generally confined to the upper extremities, and its most characteristic phenomenon is the appearance of the wrists, which hang loosely down from the forearm, and have acquired the expressive name of the "dropped wrists." Indeed, Dr. Watson would lead one to infer that the palsy from lead never affects any but the upper extremities. Pemberton, also, in his treatise on "Various Diseases of the Abdominal Viscera," mentions only the paralytic wrists, as a consequence of poisoning by lead. In the case which has been related, however, the lower extremities were paralyzed quite as much as the upper; and the affection had already existed in the former for a month, when it first appeared in the latter. The case, however, is not absolutely anomalous in this respect. It is stated, by Dr. Darwal, in the *Encyclopædia of Practical Medicine,* that lead palsy affects the "upper extremities" only, very rarely the inferior. A writer in *Tweedie's Library,* ii. 283, says: "It has been rarely observed in the inferior extremities, the hands being generally affected, though the palsy sometimes extends to the forearms. In his treatise on "Diseases of the Abdomen," in the chapter on Lead Palsy, Andral has the following sentence: "In other individuals, but much more rarely, we have ascertained the existence of complete or incomplete paraplegia, with exaltation of sensibility, and acute pains in the paralyzed limbs. In some, the upper extremities were not at all affected; in others, there was, at the same time, greater or less debility of the upper extremities." Sir George Baker, also, in an article in the third volume of the *London Medical Transactions* says: "In some patients the legs have been

paralytic for a night; and some, but not very many cases, have been remarked, in which the paralysis of the legs has been lasting."

In the case of Caroline Bright, who was in the hospital with lead palsy, in the early part of 1847, the lower extremities were partially paralyzed. The record of January 8th says: "Is not able to rise from chair; but, when up, can walk without assistance." In the case of Bridget Masterton, who was in the hospital about the same time, both upper extremities were entirely paralyzed, so that they hung down powerless by the patient's side, though she could swing them backward and forward, as if they had been attached to the shoulders by hinges. Andral mentions similar instances. "We have seen it," he says, "affect the entire upper extremities, which became altogether deprived of motion."

2. This paralysis is not accompanied by any diminution of sensibility; but, on the contrary, is particularly characterized by pain and tenderness of the paralyzed parts. The report of Bridget Masterton's case, already alluded to, is as follows: "Has much pain shooting down the limbs; never any loss of sensation in the paralyzed parts." In the case of Caroline Bright, the pain was so prominent a symptom as to lead the physician at first to overlook the paralysis, which was slight, and to diagnosticate the case as one of pure neuralgia. Andral speaks of the pain as a very important symptom. "The most common," he says, "of the nervous disturbances produced by lead, consist in pains in the extremities, and principally in the arms." "Thus we find exaltation of the normal sensibility and diminution of motion combined." He then proceeds to compare this condition of things in the arms, with that which takes place in the intestines, "where, at the same time that pain exists, there seems to be a diminution of the normal contractility of the muscular tissue."

3. Lead palsy does not usually show itself until after several attacks of colic. Pemberton gives the history of the disease as follows: "But after a person has suffered repeated attacks of this colic, he not unfrequently falls into epilepsy, or becomes paralytic in the hands." Dr. Watson, also, in describing the course of poisoning by lead, speaks of the palsy as occurring after several attacks of colic. In the above case, however, the patient had never suffered any such attack, so far as could be discovered. Nausea and constipation were her only previous symptoms referable to the action of lead. Dr. Watson, however, himself admits that, in a few instances, he has known the usual order of things reversed. "The wrists have become dropped, where there had been no preceding colic." Pereira says, also, in the article on Lead, in the first volume of his *Materia Medica:* "The palsy may occur without colic, or it may come on while the patient is suffering with it; but in general it succeeds colic." Dr. Darwal, in the *Cyclopædia of Practical Medicine,* says: "When the colic has endured for some time, and *occasionally when it has not been present,* there results a peculiar paralysis,* &c."

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* Sir George Baker, in a paper published in the *London Medical Transactions,* 1785 speaks as follows: "It may likewise be observed, that the symptoms of this malady (lead-

4. The paralysis is accompanied by wasting of the muscles, and authors speak particularly of that bundle composing the ball of the thumb. In the above case, the atrophy of these muscles was very well marked, as has already been mentioned. I think, however, it will be found that emaciation of the hand always shows itself particularly in these muscles, whether resulting from lead or any other cause. It was at one time supposed that this atrophy was occasioned in painters by the constant pressure of the handle of the paint-brush against the ball of the thumb; but this opinion was given up after the wasting was observed to take place in the left hand equally with the right.

5. The blue line round the gums, as a symptom of poisoning by lead, was first noticed by Dr. Henry Burton, who gives an account of his discovery in a paper read before the London Medical and Chirurgical Society, in January, 1840. He reports fifty patients, who presented this symptom while under his charge, thirty-six of whom had lead colic, and the remaining fourteen were under the influence of acetate of lead given as a remedy for pulmonary disease. Many of these fourteen were watched from the time they began taking the acetate, and in two of them the blue line appeared in the course of four days, after taking one of them, fifteen grains; the other, twenty-four grains of the salt of lead. Two others, had it produced after seven days. Dr. Burton also reports a case, in which a Mr. Moyle, of Chacewater, produced the blue line in twenty-four hours by giving twenty grains of the acetate of lead in four doses. A man, by the name of Cornelius Sullivan, in the Massachusetts General Hospital in May last, had colic and the blue line produced after taking fifty-eight grains of the acetate of lead in six days.

The medicine was given as a remedy for purpura hemorrhagica with epistaxis.

Dr. Burton speaks with the greatest confidence of this symptom as a pathognomonic sign of the influence of lead. He states also that the discoloration precedes all other unequivocal symptoms produced by lead, so that it is of great value as a warning to the physician that his patient has been fairly brought under the influence of the remedy. I am informed, by Dr. Dana, of Lowell, that Dr. Burton was preceded several years in his discovery of the blue line as a symptom of lead poisoning, by Tanquerel, a Frenchman, who published an account of his observations so early as 1837 or 1838. But I have not met with Tanquerel's book, and am unable to give any account of its contents.*

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poisoning), do not always follow each other in a regular and stated order of succession. Muscular pains in various parts of the body have tormented the patient some time previously to the attack on the stomach and bowels. It has likewise happened that the disease has first made its appearance in a paralytic condition of the wrists."

[*] This was before the publication of Dr. Dana's translation of Tanquerel's exceedingly complete and valuable treatise on "Lead Disease." Though that treatise gives the results of a much more thorough investigation than had ever been made before, I believe the views expressed in this paper, will be found generally in accordance with the statements of Tanquerel. J. C. D.

Other effects of lead had been noticed previous to the appearance of Dr. Burton's paper. Thus Christison states that the saliva is increased in quantity, and bluish in colour. Dr. A. T. Thomson also says that the saliva assumes a bluish colour. Dr. Burton, however, doubts the accuracy of these statements; for in all of his patients, who presented the blue line, the "substance of the gums, the smell of the breath, and the color and quantity of the saliva" remained the same as before its appearance. "I do not wish to assert," he says, "that salivation and turgidity of the gums are *never* produced by the internal operation of lead, but I venture to affirm that they are rare occurrences, and not characteristic of its influence."

The blue line may occupy either upper or under gums. In the case of Caroline Bright, it is reported as being "along upper and under edges of gums." Bridget Masterton had a "blue line next the teeth on under gums, and slightly on upper." In the case of Cornelius Sullivan, it appeared very distinctly on the edges of all the gums both on the upper and under jaw. In the case of Eliza T., it was confined to the edges of the gums belonging to the upper incisor teeth. It is not always easy to determine its exact situation. In Caroline Bright's case, the discoloration appeared to be seated rather on the tooth than on the gum. It has been thought by some to exist in the tartar collected around the teeth. It does exist, however, where there is no tartar. Dr. Watson relates a case in which the discoloration existed everywhere, except at those points where the teeth were wanting. In the case of Eliza T., I was able to make out, with tolerable certainty, that the blue line was situated in the substance of the thin edges of the gums. There was no tartar, and the gums were otherwise quite healthy.

Although Dr. Burton distinctly states, that the blue line precedes all other symptoms of lead, he does not say whether it remains after the other symptoms have passed off. The truth seems to be, that it is more permanent than colic, but about equally so with paralysis. It has already been mentioned, that in Eliza T.'s case, the discoloration faded from the gums in about the same proportion as the patient regained the use of her feet. In the case of Cornelius Sullivan, who had colic alone, without any paralysis, the blue line was quite distinct about the gums for a week after the pains in the abdomen were entirely relieved.

6. Another important symptom of poisoning by lead is, the depressed aspect and manner of the patient while under its influence. In the case which I have reported, there was a remarkable timidity and *shyness*, considerably greater than is usually exhibited by children of her age; and, when frightened, she did not become boisterous and noisy, as children usually do, but cried in a quiet and hesitating manner, as if she were terrified into silence. In the case of Caroline Bright, this depressed and retiring manner was equally well-marked. Dr. Christison mentions the same thing, in the article on Lead in his Dispensatory. "It thus induces," he says, "in the first instance, severe dyspepsia, with obstinate constipation and *gloominess of mind.*" He also

speaks of the palsy as being accompanied, among other symptoms, by "great lassitude, restlessness, anxiety, and gloominess of spirits." (*Christ. Dispensatory,* p. 700.) Sir George Baker also says: "Sometimes the approach of it is announced by a leucophlegmatic and yellowish complexion, restlessness of mind and body," &c. &c. (*London Medical Transactions,* vol. iii.)

So far as has yet been ascertained, the poison of lead causes no very remarkable organic lesion in the intestines or the nervous centres. Orfila relates three autopsies after death from lead colic. One of these was that of an animal, which had been confined in a warehouse of "minium," or red oxide of lead, and had died in convulsions. There was found only a "somewhat distinct" contraction of the intestines. Another, was a patient in La Charité, in whom the "whole of the colon was shrunk in diameter," but no other morbid appearance was observed. In the third case, also that of a patient at La Charité, the colon and rectum are said to have been "empty, and exceedingly contracted." Andral reports six cases, in none of which was there any sign of inflammation, as e. g., redness, thickening, or ulceration. In one of them, he says, the calibre of the digestive tube was "neither diminished nor increased." In two others, the intestines were "rather dilated than contracted;" and, in a fourth, there was "nothing remarkable in the intestines; only, in some few places, they were contracted, and slightly strangulated, but without any trace of inflammation." Autopsies of persons affected with lead palsy, have been less numerous. Andral reports two, in which the brain and spinal cord were carefully examined, without any appreciable lesion being discovered. Another of his patients died with epileptic symptoms during an attack of colic, and, in this case, the nervous centres were equally free from disease. The poison of lead acts as well on animals as on man, which is, by no means, the case with all poisonous substances. It is stated by Dr. Dana, of Lowell, (Pamphlet on Lead-pipes,) that a horse "may take daily, for weeks, several grains of arsenic without any other effect than a softer and more silky skin. Pereira (*Materia Medica*) says, that one experimenter gave tartarized antimony to a horse in so large a dose as six drachms, "without perceiving any remarkable and permanent derangement in the exercise of the principal functions." Pereira states also, that among the carnivora, generally, opium has only a very slight narcotic effect. Lead, however, appears to act as energetically on animals as on man. In *Copland's Dictionary of Medicine* (Arts and Employments), an account is given of the effects produced on cows, sheep, &c., by pasturing among the lead hills of Scotland. These effects were principally constipation, colic, and convulsions. Orfila relates a considerable number of experiments on animals, made with a view to discovering an antidote for lead. In one of these experiments, five grains of the acetate were injected into the jugular vein of a dog without any immediate effect; but on the third day, the animal became dejected; on the fourth, his movements were tortuous and difficult, and his posterior extremities were weaker than the anterior. He died on the fifth day. Unfortunately, only the lungs and stomach were examined; but these appeared uninjured.

The failure to detect lead in the urine of Eliza T., is no more than might have been anticipated from the results of previous experiments. Orfila, in the second volume of his work on "Poisons," speaks decisively on this point. "It will be in vain," he says, "in cases of colic produced by metallic effluvia, to have recourse to experiments made on the excrements and urine. Analysis proves that it is impossible in these substances to discover the lead. MM. Barruel and Merat examined the urine of a person affected with this disease. It was not at all disturbed by the addition of hydrosulphate of ammonia, and the part which subsided did not exhibit the least vestige of lead. On comparing the results with those given by the urine of a healthy person, they saw there was not the slightest difference."

The excrements were also examined for lead by the same chemists, but none was discovered. Since that time, however, Orfila is said to have detected lead in the urine of a girl who was poisoned by a large dose of the acetate. The case is reported in the *Bulletin of the Royal Society of Medicine*, at Paris, for 1840, a book which I have not been able to obtain.*

Dysuria was noticed as a well-marked symptom in the patient whose excretions were examined by Barruel and Merat. In the case of Eliza T., the nurse reported for three weeks after her entrance, frequent and scanty micturition without pain. In the case of Caroline Bright, the record says: "Urine reported natural; no dysuria, but occasionally obliged to pass it very frequently." In the case of Bridget Masterton, the urine is simply reported as "natural."

With regard to the prognosis and treatment in lead palsy, authors vary. Christison says (*Dispensatory*, p. 700), that the affection is "always very obstinate, yet, for the most part, curable under tonic treatment, graduated exercise, attention to the bowels, and avoidance of the cause of the disease." Sir George Baker speaks less encouragingly. "In this palsy," he says, "beneficial effects have in vain been expected, as well from the external application of stimulants to the part affected, as from the electric influence, however modified or directed." The bath waters, however, he thinks, have been beneficial, and he has known "more than a single instance of restoration of palsied parts after their use for several years." "Great benefit, too," he says, "has been derived from a course of warm bathing." Electricity and the warm douche are spoken of by Dr. Watson as "promising expedients."

I find in the records of the Massachusetts General Hospital, eleven undoubted cases of lead palsy, four of whom either recovered entirely, or were considerably improved; five were slightly improved, and two were discharged no better than when they entered. Three of them had already recovered from previous attacks, which had been simultaneous with an accession of colic. The two patients who recovered perfectly had neither of them had the paralysis for more than a week, and in both it accompanied an attack of colic. One of them had a warm bath daily; the other, no treatment beyond occasional cathartics.

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* Since more thorough and delicate analytical processes have replaced the comparatively bungling methods of earlier times, lead has been more frequently detected in these cases; as by Devergie, and by Tiedemann and Gmelin. It is now, I believe, sufficiently well established that, even in cases of chronic poisoning, the lead may, sometimes, be detected, not only in the urine, but also in the blood and bile, and in some of the solid textures, as muscles, brain, liver, &c.—J. C. D.

Andral reports nine cases of palsy from lead, six of whom were either cured or much benefited while under treatment by strychnine and brucine. The others, however, experienced the specific effects of the drug without any improvement in the muscles.

On the whole, it seems to be the fact that recent cases of lead palsy, especially that accompanying colic, may recover without any other treatment than removing the patient from the influence of lead, and relieving him of his colic; but that cases of long standing are apt to be obstinate under any treatment, though still not hopeless. Avoidance of the cause of the disease seems, in fact, to be the most important and effectual of all remedies, and it is to that, more than to anything else, that I am inclined to attribute the recovery in the case which I have reported. Next come good air, good diet, and exercise in the open air. If these fail, electricity, Pemberton's splints, and strychnine would seem to be worth the trial. Sulphuric acid is entirely a theoretical remedy, but is probably harmless in itself, and indeed might be useful as a tonic, if not as an antidote. The healthy state of the brain and spinal cord in those cases which have been examined after death would not lead us to expect much benefit from counter-irritation near the spine or head.

It remains only to determine the method by which lead could have been introduced into the system in the case which I have reported;—and I think there is no reasonable doubt that this was accomplished by means of the water, conveyed through leaden pipes, which the patient was accustomed to drink. It seems remarkable that this fact, of the deleterious effect of water conveyed through leaden pipes, should so early have attracted attention, and yet should be doubted by so many intelligent persons at the present day. Vitruvius, in his work on "Architecture," condemns the use of lead pipes for conveying water, on account of the "cerusse," or carbonate of lead, which is formed in them; and Galen says, that water brought through lead pipes "makes those drinking it subject to disorders of the bowels." The subject has attracted attention at various times since then, but apparently has not even yet been definitely settled. In Kane's "Chemistry," it is stated that the impregnation of water by lead is prevented in general by the small quantities of saline matters, principally sulphates, which all ordinary spring and river waters contain. "No danger," he says, "is therefore to be apprehended from the supply of water to a city being conveyed through leaden pipes, and preserved in leaden cisterns; for *all water* of mineral origin dissolves, in filtering through layers of rocks, in its passage to the surface, a sufficiency of saline matter to serve for its protection." The most detailed examination of this subject, however, seems to be that by Dr. Christison, in his treatise on poisons. It appears from his investigations that rain water, and even the purer kinds of spring water, will dissolve lead in considerable quantities, but that a certain proportion of saline matter, held in solution, prevents the action taking place. The most efficient of these protecting salts are the phosphates and sulphates; others are less so in proportion to the solubility of the salt produced by the combination of their acid with the lead. Subsequent writers seem to have remained satisfied with these conclusions. Dr. Dana, of Lowell, in a recent pamphlet, however, has taken a different view of the matter. His attention was called to the subject by the following circumstances. For several years previously, obstinate and repeated attacks of colic had been of frequent occurrence in Lowell, often remarkably numerous and severe in particular districts, and especially in one section of the city called "Chapel Hill," and its immediate neighbourhood. Some of these cases were accompanied or followed by paralysis, as in the instance of Caroline Bright, already referred to, who had lived for some time previous to her illness in this part of the town. On inquiry, it was ascertained that nearly all the inhabitants here used lead pipe to convey well water over their houses; and that, in several instances, these pipes, when removed from the wells, were found corroded to a considerable extent. And not only so, but in some cases the owners of houses had been obliged to take up and renew their pipes, because they had actually become perforated and incapable of holding water. I have in my possession a piece of lead pipe from one of these wells, the surface of which is irregularly corroded, as if worm-eaten, over its whole extent, and at several points complete perforation has taken place. This fact, therefore, that lead pipes *are corroded and perforated* by the water of some wells, is a sufficient refutation of the theory of its protection by saline matter, however respectable may be the authority by which this theory is advanced. Neither is the fact by any means a new one, though it seems to have been for a long time practically neglected. In one of Sir Geo. Baker's earliest communications to the London College of Physicians on this subject, there is a letter from a Dr. Wall, who gives an account of a certain family in his neighbourhood, of whom the mother was paralytic, and the children all subject to disorders of the bowels. Several of the family died, and the house was sold. The next occupant found the "leaden pump" belonging to the premises in so leaky a condition, from corrosion of the lead, that it was necessary to repair it, and the pump maker who was employed said that he had several times been obliged to do the same thing, on account of the same difficulty, during the stay of the original occupants. The same thing has happened in Lowell. Mr. David Dana, the most extensive plumber in the city, states, that he "used often to be called to repair pipes which had become leaky from the action of the water perforating them."

In view of these facts, Dr. Dana examined the subject with some care. He ascertained that the natural waters of Lowell all contain saline ingredients, the most abundant of which are sulphate of iron, nitrate of lime, and chloride of sodium; and that the waters of the district called "Chapel Hill," abounded chiefly in sulphate of iron.

He concluded that, if natural waters contained only one salt, the exact proportion and protective action of which could be easily ascertained, the whole matter would be very simple;—but in point of fact, there are several salts existing together in solution in well water, very often in company with vegetable acids; and that these act on each other, and modify each other's action on the lead.

The dangerous results liable to ensue from this mutual action are principally threefold.

I. The production of chloride of lead, which is soluble in water.

II. The production of nitric acid, which readily dissolves lead, &c.

III. The production of carbonate of lead, which, though insoluble, is liable to be introduced into the system in a state of suspension, and is, therefore, nearly or quite as dangerous as if soluble.

There still remain two objections to the supposition that, in the case of Eliza T., the poison was introduced into the system in water conveyed through lead pipes. The first is, that an interval of five weeks took place between her being exposed to the influence of lead water, and the first appearance of paralytic symptoms. The second is, that none of her family were similarly affected. In answer to the first objection it may be stated, that the constipation and occasional nausea continued up to the time of the paralysis, showing that the constitution was under the influence of lead. Paralysis, however, may be produced after an interval of time without any intervening symptoms, as appears from a case referred to in the first volume of *Pereira's Materia Medica* (art. Acetate of Lead). "This patient, a boy, fifteen years of age, took from a quarter of a grain to two grains four times a day, till he had taken 130 grains, without any ill effect. A month after, he was seized with colic, which was followed by paralysis and death."

The second objection, viz., that none of her family were similarly affected, is one very frequently urged, not only by the vulgar, but also by medical men. In Lowell, it was found to be generally difficult, and often impossible to convince people of the danger of using lead pipes for conveying water on this very account, because all the inhabitants of a district did not feel the poisonous influence in an equal degree. In the case of Eliza T., when it was first suggested to the physician who had had charge of her, that she might have been poisoned by lead in the aqueduct water, he remarked, that "that was impossible, since she was the only one of the family who had been paralytic." But it would certainly be surprising, if the poison of lead were the only one whose action was not modified by particular idiosyncrasies. There are a sufficient number of instances on record, to prove that the energy of its action varies greatly with different individuals. Dr. Watson states, that "persons have been known to suffer colica pictonum, in consequence of their sleeping for a night or two in a recently painted room." On the other hand, he has himself "seen a patient, who became affected with the disease for the first time after working in white lead for nineteen years." In Dr. Burton's report of his observations on the blue line, he remarks particularly on this modifying influence of idiosyncrasy. "For some of my patients," he says, "were much more obnoxious to its influence than others, under circumstances apparently similar." It will be remembered that the little girl, Eliza T., was very young, and had been, at one time, much exposed to the unfavourable influences of cold and moisture. This may, perhaps, have had some influence in making her more sensitive than others to the poisonous effects of lead.

ART. V.—*A Detail of certain Experiments, performed by Magendie and Bernard, in the College of France.* By WILLIAM H. ANDERSON, M. D., of Mobile, Alabama.

IN the winter of 1848, the writer of this article witnessed a large number of experiments, vivisections, &c., made by Magendie and Bernard, for the purpose of elucidating some of the more mysterious functions of the digestive, nervous, circulatory, and respiratory apparatus. Among others, a series of experiments was instituted, to ascertain the action of various poisons, the therapeutical effects of which have been much sought after of late years. We proceed to detail the facts relative to several of these medicaments.

Strychnia.—Of all the extracts, the alcoholic is undoubtedly the best, but even this is uncertain, and should be administered with caution. The great difficulty seems to be in arriving at a proper strength; for two preparations made precisely in the same manner, are frequently found to possess different degrees of activity. Trousseau was the first to remark this, in the case of a patient under his care at hospital Neckar. To obviate the difficulty, the alkaloid should always be given in substance, and the same rule holds good with regard to all the powerful alkaloids.

Strychnine is a very active substance, and when given in poisonous doses, either to man or the lower animals, it produces death by convulsions. Hence, it bears especially upon the nervous system. It has no action on the brain, and produces its effects equally as well when this organ has been extirpated. To prove this, Magendie removed the brain of several animals, and the administration of the poison was followed by the same effects. A careful analysis of the experiments of Bernard and Magendie leads to the belief that strychnine has a reflex action; that it acts on the periphery, not on the nervous centres. An exaggeration of the reflex action, therefore, is its true modus